Small Business Innovation Research/Small Business Tech Transfer

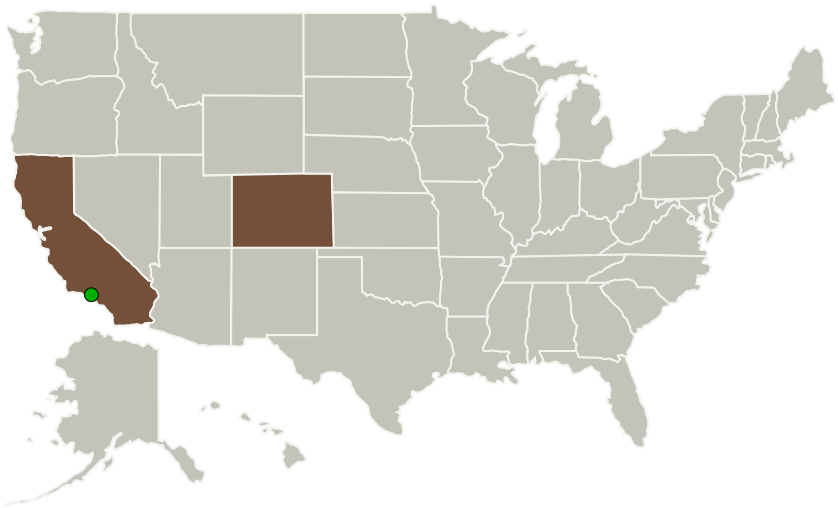
Balancing Autonomous Spacecraft Activity Control with an Integrated Scheduler-Planner and Reactive Executive, Phase I

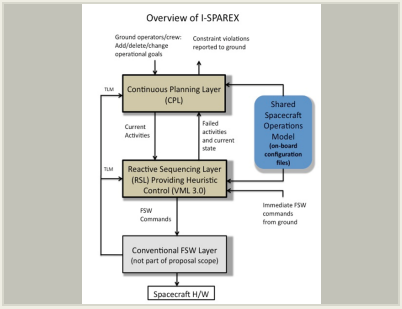
Completed Technology Project (2013 - 2013)

Project Introduction

Spacecraft operations demand a high level of responsiveness in dynamic environments. During operations, it is possible for unexpected events and anomalies to disrupt the mission schedule, and in the case of critical faults, even threaten the health and safety of the spacecraft. Historically, it has been the responsibility of the mission operations team on the ground to issue command sequences and monitor spacecraft health and status to ensure that long-term science, engineering, and safety goals are achieved. Red Canyon Software is building upon previous designs for on-board, layered autonomous software flight systems employing continuous planning and command sequencing. The proposed innovation increases the robustness of on-board autonomy for space vehicle operation, while at the same time offers reductions in mission development costs by leveraging off of newer flight proven software technologies. Also, developing, verifying, and validating spacecraft activity and constraint models for use with model-based autonomous planners and reactive sequencers are difficult and complex activities. For robust, on-board autonomous systems with multiple layers of software performing varying levels of constraint checking prior to activity planning and command sequencing, more than one layer will need to be configured with the same model constraints. To reduce the cost and risk of model development and use, a single, shared spacecraft domain model representation is proposed, along with development of a graphical editor that allows system engineers to easily encode domain information and that uses verification rules to detect inconsistencies or errors.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Red Canyon Software	Lead Organization	Industry Historically Underutilized Business Zones (HUBZones)	Denver, Colorado
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Colorado

Project Transitions

May 2013: Project Start

November 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140408)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Red Canyon Software

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Robert Radicevich

Co-Investigator:

Robert C Radicevich

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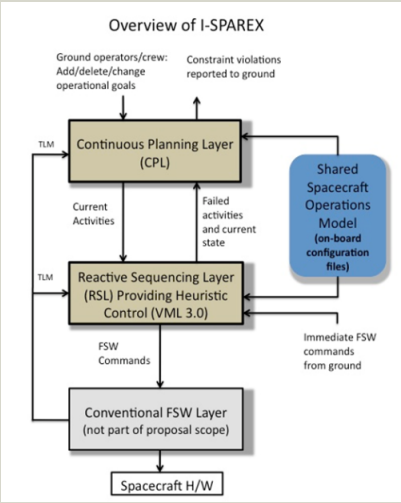
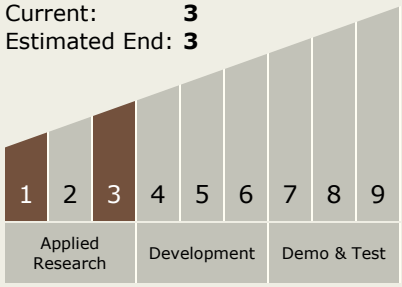
Images



Project Image
Balancing Autonomous Spacecraft Activity Control With An Integrated Scheduler-Planner And Reactive Executive
(https://techport.nasa.gov/image/132761)

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.2 Reasoning and Acting
    - TX10.2.4 Execution and Control

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System